INFLUENCE OF WEIGHT OF GOVERNOR BALLS ON SPEED OF CORLISS ENGINE

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1913

INFLUENCE OF WEIGHT OF GOVERNOR BALLS ON THE SPEED AND ECONOMY OF A SIMPLE CORLISS ENGINE

A THESIS

PRESENTED BY

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TO THE

PRESIDENT AND FACULTY

OF

ARMOUR INSTITUTE OF TECHNOLOGY

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

HAVING COMPLETED THE PRESCRIBED COURSE OF STUDY IN

MECHANICAL ENGINEERING

MAY 29, 1913

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The Influence of Weight of Governor Balls on the Speed and Economy of a Simple Corliss Engine.

..INTRODUCTION..

The aim of this thesis is the exact determination of the effect on the economy and the speed of a simple Corliss engine with a flyball governor, when the weight of the governor balls is varied, and the brake horse power output is kept constant. The distance of the centers of gravity of the balls to the pivot of rotation, and the steam pressure are also kept constant.

A series of six runs was made, each run with a different weight of governor ball. Each run was of thirty minutes duration, during which time observations of speed, steam consumption, power output, and position of running of governor were

observed at regular intervals. Check runs were made where the exact result was doubtful. Balls of the following weights were used. 16.25#, 25.0, 28.5, 31.5 and 35 lbs.

..DESCRIPTION..

The engine upon which these tests were made is a simple horizontal Corliss valve engine; built by the Chalmers Company of Milwaukee, Wisconsin. The cylinder has a bore of nine inches and a length of twenty four inches. The governor of the engine is of the common, loaded, flyball type with safety attachment. The engine is equipped with a Wheeler surface condenser, Prony brake and attached revolution counter. It is rated at twenty-five (25) horse power.

...METHOD...

The engine was run at a constant steam pressure of 75# per square inch, exhausting at atmospheric pressure into a surface condenser. It was allowed to run for approximately fifteen minutes before each test run was made; so as to assure

constancy of conditions. The "no load" speed was observed and the plane of revolution of governor balls marked on the chart, arranged so as to receive a multiplied movement of governor balls of 4:1 by means of a lever arrangement shown in photograph.

The brake load was applied gradually until twenty-five horse power was developed. The period of "hunting" of the governor was observed. On the resumption of constancy of conditions the actual run was begun. Indicator cards were taken at intervals of five minutes, and observations of speed taken every two minutes. The chart showing the movements of the governor during the run was obtained. On the completion of the thirty minute run, the condensed steam was weighed and the weight recorded.

As steam was slowly admitted to the cylinder the engine gradually accelerated up to a point where it seemed suddenly to begin to race. The governor balls rose to their highest position possible and the steam was cut off correspondingly. The engine then reduced in speed and the governor "hunted" for a short period and finally settled in one definite position. The "no load" speed was determined while the engine ran thus constantly. As the load was gradually applied, the governor balls lowered slowly but with some fluctuation.

. .DISCUSSION..

The fluctuation was more pronounced with the light balls; which fact indicates that the lighter the ball the more sensitive is the governor. The planes of revolution of the heavier balls on "no load" and "full load" are lower than

that of the lighter balls, showing that the cut off must come later. The speed of rotation of the engine was slower with the heavier balls on the governor, but the brake load was proportionately greater so that the brake horse power remained constant.

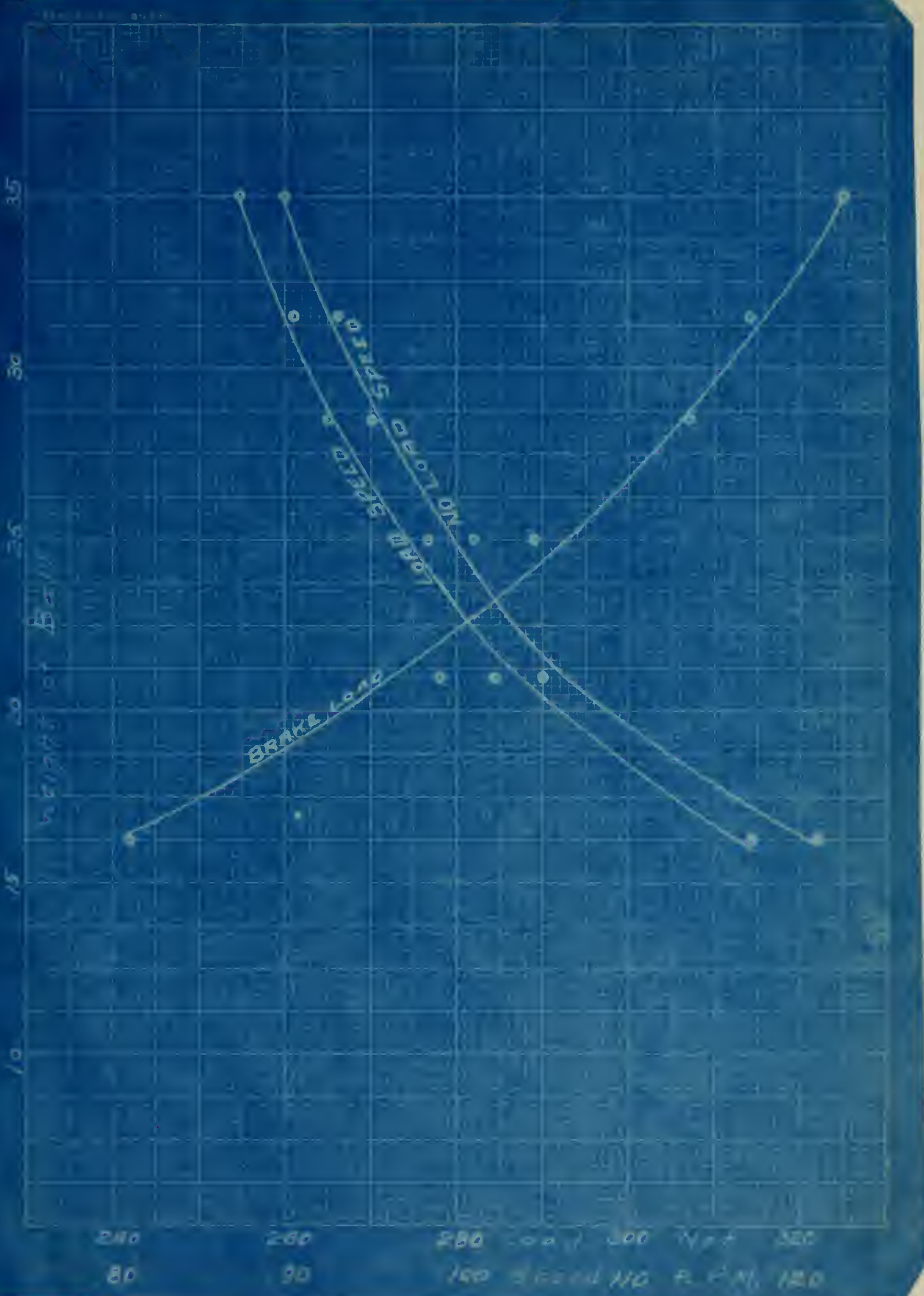
The mechanical efficiency and the economy of the engine did not vary according to any discernable law; as is evident upon the inspection of the log sheet. The "no load" speed is perceptibly greater than the "full load" speed for a given weight of governor ball. The "no load" speeds varies the same as the "full load" speeds for any two different sets of balls. The speed of the engine remained practically constant throughout each run, after the "settling" of the governor. Any slight change in steam pressure was readily observed by means of the oscillatory action

of the arm on the governor. The curves drawn show clearly the relations between weight of governor ball and speed and weight of governor ball and brake load.

The conclusions to be drawn from this test are that the speed of the engine is affected by a variation of weight of governor ball. The variation seems to follow a definite law, almost a straight line law. The heavier the governor balls, the slower will be the speed of the engine with relative increase in torque. The mechanical efficiency and economy are effected by a variation of the weight of governor ball, but not according to any law. The infinite number of variables such as bearing friction, quality of steam, slight variations in lost motion in machinery, etc. have their influence, no doubt, upon the mechanical efficiency and the steam consumption.

The curves succeeding on page nine are those described by lever arm multiplying device attached to the vertical moving spindle of the governor. The curve is marked for the size of ball on governor. The points marked A_1 A_2 etc. indicate the position the governor assumed after "settling", with the engine running with "no load". Points marked B_1 B_2 etc. show position of governor when engine was developing full horse power.


16.25
20.8
25.0
28.5
31.5
35.0
A1
A2
A3
A4
A5
A6
B1
B2
B3
B4
B5
B6



35
30
25
20
15
10
NO LOAD SPEED
LOAD SPEED
BRAKE LOAD
80
90
100
120

TABLE 1

Weight of Ball	No Load Speed	Full Load Speed	Brake Load	I.H.P.	B.H.P.	Mech. Eff.	Steam #/I.H.P. hr	Steam #/B.H.P. hr	No. of Run
16.25	121	117.4	242	29.8	25.23	84.7	32.7	38.6	1
21.0	105	102.3	278	28.3	25.24	89.3	35.1	39.3	2
25.0	101	98.3	289	28.8	25.23	87.7	33.1	37.8	3
28.5	95	92.5	307	28.3	25.21	89.2	32.3	36.2	4
31.5	93	90.4	314	28.8	25.21	87.6	30.4	34.7	5
35.0	90	87.4	325	28.0	25.23	90.2	33.8	37.4	6